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RF Regional Technical Centers for MPC&A Sustainability Operations

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DISCLAIMER

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ABSTRACT

The National Nuclear Security Administration (NNSA) programmatic vision to be a catalyst in Russia's assumption of responsibility for long-tRRerm system operation is exemplified in the sustainability cooperation with the RF Ministry of Defense (MOD). An identified goal for the MPC&A Program is to encourage the development of Russian Federation (RF) capabilities and commitments to operate and maintain safeguard improvements. The RF MOD Technical Support Center development fulfills the NNSA mission and MPC&A Program goal. The regional technical center concept involves a systematic approach to aid in the determination of the level of sustainability assistance required to transition operators, maintenance, training, and testing of MPC&A systems to the RF MOD. This paper describes the process used to create the RF MOD Technical support center. First are described the needs analyses conducted to determine the key system sustainability factors requiring support. These sustainability functions are then compiled to influence the form and ultimate physical design of the technical support center. Operational interfaces are described, in detail that show the benefit of the center to the individual sites. Finally, benefits relating to information accessibility and other economies of scale are described that highlight the central center concept's strengths.

BACKGROUND

For the past several years, the Russian Federation Navy (RFN) and the U.S. National Nuclear Security Administration (NNSA) Material Protection Control and Accounting (MPC&A) Program have been working jointly to upgrade the security systems at RFN and Russian Federation Navy (RFN) facilities. To date, several facilities have completed safeguards and security system upgrades and several more will be completed in the near future. In order to ensure the sustainability of these systems, a strategy was developed to ensure long-term, efficient performance of the upgraded sites through technical support centers after the US MPC&A program support ends. For planning purposes, long-term sustainability goals include four topical areas to be addressed (does not imply US financial support for every component):

- Training
  - General and site-specific
  - Technical system operators
  - Maintenance of MPC&A equipment
  - Response force, performance testing, methodologies
- Regulations
  - General and site-specific procedures
  - Technical Support Center

    - Inspection
- Maintenance and Testing
    - Technical repair, replacement, preventive maintenance
    - Functional, operational, and acceptance testing of MPC&A equipment
    - Response force testing
    - Data tracking and trending
    - Record keeping
- Life-Cycle Planning
    - Equipment and human resources
    - Use of data
    - Budget planning
    - Sustained risk reduction

The primary goal of a technical support center is to institutionalize sound MPC&A support infrastructure within the RF MOD so they can become self-sufficient in sustaining all system component upgrades, and human resource applications. Within the framework of meeting basic sustainability goals of the RF MOD, technical equipment upgrades, operating procedures, and training are all evaluated through planned performance testing. More importantly, the technical center implementation of sustainability measures must be based on sound regulatory authority and documentation (Figure 1).

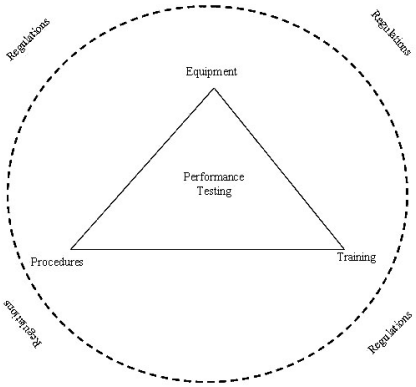

Figure 1 Sustainability Circle

Grouping of solutions to Kola Region site support functions into the support center will allow for realization of economies of scale and centralized support for system operability at RFN sites. This center is being constructed to assure the minimum appropriate infrastructure elements to sustain the MPC&A elements in place are in place for the Kola region sites. The objective is to eventually reduce the level of US contribution to zero and transfer full responsibility to the RF MOD.

The Russian Research Center Kurchatov Institute (RRC KI) continues to serve as the primary intermediary contracting organization between the RF MOD and DOE NNSA Headquarters (and its National Laboratories), and plays a key role in the implementation of the MPC&A upgrades at RF MOD sites. The RRC KI has been cooperating with the RF MOD for over 50 years. The traditional role of KI was because RRC KI developed nearly all of the designs for RF naval nuclear reactors and their fuels.

NEEDS ANALYSES FOR TECHNICAL SUPPORT

To provide only the technical support required for MPC&A upgrades at sites, several phases of needs analysis were jointly conducted for the areas of training, maintenance, testing, and administration.

Training

The initial training support development phase consisted of a high-level training needs analysis completed in July 2002. This analysis determined the major MPC&A-related functions requiring training and the framework for a training program. The next step was to use the needs analysis data to begin scoping the overall technical center design and determine the number and size of classrooms, and the number of training specialists required. The analysis was a tabletop group exercise that included RF Navy, Kurchatov and US personnel (Figure 2).

GROUP 2 - (10 per class – 20% turnover twice per year)
CONSOLE OPERATOR

Audience	Training (Function)	Estimated Number of Trainees Per Year	Course Length	Estimated Courses Per Year	Classroom and Lab Use By Weeks
Console Operator (108)	Console Operations Access Cameras PP extensive knowledge Emergency response Alarm response Stationary radio/telephone	108	4 Weeks (20 Days 160 Hours)	11	22 Weeks Lecture Room 22 Weeks Console Lab
					22 Wks Rm **22 Wks Lab**

1 Regular Classroom needed for 22 Weeks. See Technical Services.
Classroom shared with Technical Services.
1 Console Lab needed for 22 Weeks. See Technical Services.
Console Lab shared with Technical Services.

Figure 2 Tabletop Training Needs Analysis Example

Maintenance

Program guidance for system maintenance has been developed through national program efforts. The need to minimize unacceptable system outages, while providing a resource for compiling and analyzing system data, has always been a program priority. The opportunity presented by the existence of many Kola Region facilities under single command will allow for effective use of a central maintenance support entity.

The RF MOD recognized a need for a consistent and systematic approach to maintenance work control and system testing. Effective system maintenance is essential for their protection systems' long-term sustainability. The methodology to implement such a maintenance methodology is documented in the program literature and good examples exist in contracts and case studies of the MPC&A program's interface with the Russian side on the issue of maintenance.

Management of the RF MOD's maintenance activities can be achieved using "brute force" methods including paper logs, computer databases, spreadsheets, schedulers, etc. An alternative to this

approach has been provided by an International Proliferation Prevention (IPP) project as a commercially available, Russian version of a software package called MAXIMO. MAXIMO is a modular program that integrates equipment maintenance documentation processes with inventory, resource, performance testing, and personnel tracking capability. Essentially all of the components described above are rolled up into a single package oriented specifically toward maintenance and testing management.

Performance Testing

Performance testing for MPC&A systems can be best described as a "spectrum" with the extremes being defined by the following two test modes:

- Functionality testing – to determine simply that system subcomponents to operate according to their design characteristics.
- Operational (effectiveness) testing – to determine the continued operation of a system and its components within operational procedures and requirements; includes post-maintenance testing and alarm walk testing
- Broad scope performance testing – to determine that a system meets the mission in its broadest definition. These tests are expensive, complex, and difficult to control. They are sometimes referred to as "Black hat" testing.

The continuum is established by the test scope. At the functional test end of the spectrum the scope is most limited. At the "Black Hat end, the test scope is most broad. This continuum is presented in Figure 3.

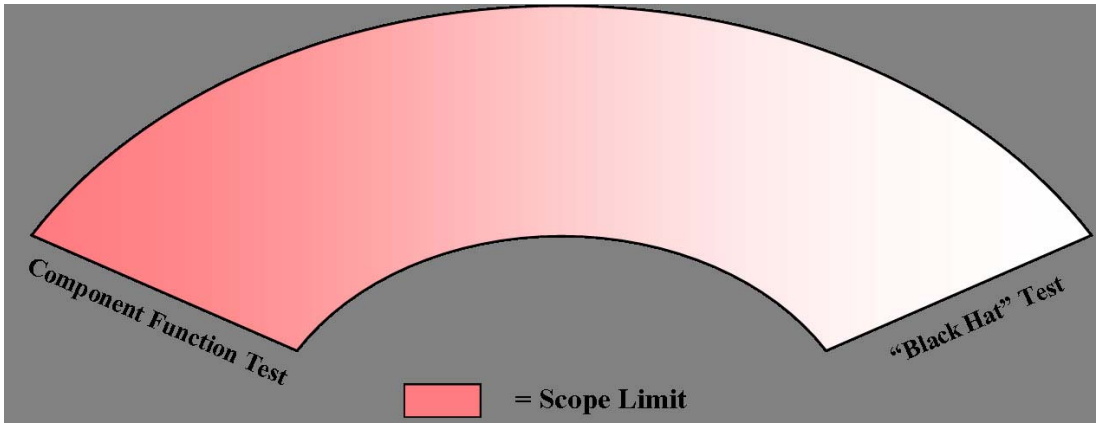

Figure 3 System Test Scope Continuum

The role of the TSC is to support various individual site activities and act as an information repository. Sites in the Kola Region will have a site testing plan that will be complemented by the TSC, which will conduct longer period functional tests and all other tests of varying scope as described by the System Test Scope Continuum.

Since the TSC will develop and maintain the master copy of the Comprehensive System Evaluation Plan for the region, the facility will also collect data resulting from system evaluations. From this information, TSC staff will prepare reports for DOE/NNSA assurance of continued MPC&A system operation. For the RF MOD, staff will analyze the testing data (in concert with maintenance and training data) using statistical tools to measure health of systems and identify areas for system improvement.

OPERATIONAL COST ANALYSIS

The average costs for upgrading sites in Russia vary according to a multitude of factors. Therefore, empirical cost data for ongoing operations as incurred by the RF MOD for MPC&A is unclear. One reason for the lack of a clear definition of the ongoing cost includes the fact that the infrastructure support systems that are a large part of sustainable comprehensive upgrades are still maturing. These include provision for ongoing maintenance, system testing, personnel training and other life cycle management issues. As the program continues to develop these infrastructure elements, the required steady state resources will become clear. The technical support center concept, as it is implemented, will also aid in collecting data that will give a clear picture of the ongoing operational cost to operate the site.

Projects upgrading systems for the protection of nuclear material involve certain non-recurring or project costs that are well understood by the program, due to many years of experience. What is not totally understood is the recurring, steady state or operational costs associated with long term operations. These costs have traditionally been borne by the Russian site's MPC&A program at some level or another and include electricity and other utilities, staffing resources, and special technical knowledge. The more complex and technology-driven the MPC&A upgrades installed, the more resource intensive they are on the Russian sites to sustain them. Not only do the more complex upgrades result in an increase in operational costs, but also illuminates the need to enhance the safeguards and security culture among officials, managers, and workers. In order to understand both the new resource burden categories and the amount of money required to support these areas, an Operational Cost Analysis (OCA) must be completed.

An OCA will be useful for resource planning at each stage of the upgrade process. Before upgrade, the OCA relative to hardware support will be useful to determine the long-term recurring cost that will eventually be born by the Russian Federation. This information should directly influence the choice of system components and levels of upgrade necessary to protect target materials adequately (lower recurring cost systems being more desirable). A 10-year system life cycle is generally being assumed for most of the hardware systems proposed.

For sites involved in upgrades, or where upgrades are complete, a more comprehensive OCA has benefits, particularly to Russian Federation managers. In these cases, the recurring cost of system support should be described in each of several main functional areas (Figure 4). The purpose of the analysis at this stage will be for assurance of the proper direction of ongoing operational funds provided by the US, and for data to be used in formulation of strategic decisions about transition of upgraded systems to total Russian management.

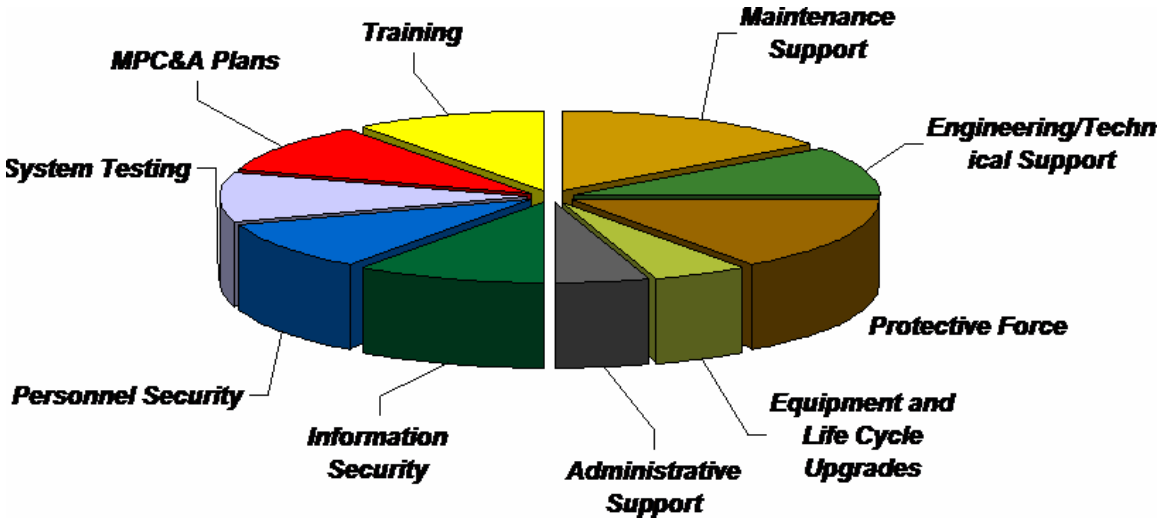

Figure 4 Operational Cost Analysis Functional Areas

Data that indicates operational cost analyses have been completed and are maintained include pie charts showing resource allocation in each of the defined support areas; data from site cost management systems; projection analyses guided by program exit strategies and specific exit or transition strategies referencing the OCA.

THE TECHNICAL CENTER CONCEPT

Technical upgrades are only the initial commitment to ongoing nuclear protection at Russian facilities. The ongoing support of these systems will require an effective infrastructure that must be sustained by the Russian Federation for years, particularly after the era of cooperation with the U.S. is ended. Additionally, RF MOD site locations are remote, primitive, and not generally supported well by local populations, regional, or national support elements. To provide each site with the essential infrastructure required for system support (training, maintenance, spare parts, system testing and technical support, to name a few) is expensive. Because the RF MOD sites are similar in construction, mission and supported by a homogenous RF MOD chain of command, it is most beneficial to consolidate and group similar functions in a technical support center.

In general, the program established the support center concept through a number of steps completed over many months. These steps included:

1. Determination of MPC&A Program Objectives for Sustainability – This was achieved through interaction with the MPC&A Operations Project and following a set of operational criteria for sustainability. The result was a list of "must do" items for sustainability and included system maintenance, testing, operational configuration management and operational data gathering and processing.

2. Accommodation of RF Navy Needs into the conceptual design – The RF Navy was consulted on a number of occasions to assure that support proposed for sustainability was actually needed and consistent with goals of their national and regional orders.

3. Completion of preliminary facility design – This task was completed through interactions with the Kurchatov Institute (serving as technical liaison for the US team to the RF Navy). This step was important to identifying the geographical location of the facility and its general size.

4. Finalizing detailed functional description – During a technical exchange held in the US in spring of 2002, a joint committee met to negotiate supported functions including; the number of training classes to be held, support services provided by the TSC, and equipment needs. The discussion ended only after the group conducted a "room by room" functional description exercise.

5. Completion of final design documentation – Completed by the Kurchatov Institute/NNSA team in early 2003, this exercise involved construction design documentation and estimates, equipment lists and a very detailed package estimating cost.

The first RF MOD technical support center will provide to the sites in the Kola region, support services in the following areas:

Maintenance and Testing – The TSC will provide a central cache of spare parts for the systems installed in the RF MOD facilities. They will also provide maintenance services and transportation to the sites for extensive system repair. Some limited emergency repair capability will be maintained at the sites for critical system elements. They will also provide for periodic system functional testing and for the more extensive system effectiveness testing that will prove the ability of site to meet its material protection goals.

Training – The TSC will serve as a central training facility for system operators, system administrators, responders and maintainers. There will be functional system mock-ups provided in classroom settings for operations simulation and system maintenance training. There will also be a full training curriculum maintained at the facility and on-site trainers who maintain their expertise through continued contact with information systems, vendor data, regulatory concerns and RF MOD command media.

Technical Support – The TSC will serve as the "hot line" for calls from operations personnel at the RF MOD sites for system operations and maintenance problems.

Data Analysis and Reporting – As a central collection facility for maintenance and testing and training data, the TSC will serve as an ideal location for the analysis of site specific and broad trends for system operations. Simple statistical tools will be used to analyze operations and failure modes for continuous system improvement. Broader trends can also be observed regarding human resource planning and management.

Based on the assumption that the elements described above are essential for effective system operation, the TSC will play a critical role in system support for the region. The aggregate cost of all of the above elements for each of the RF MOD sites would be tremendous if small versions of the TSC were set up at every location. This cost, of course, would far exceed the initial cost of establishing the TSC. The short-term cost differential aside, economies of scale to the RF MOD will be also realized in the long term, efficient support of systems in the region.

Another benefit of the TSC concept involves its role as liaison for the U.S. MPC&A Program personnel with individual RF MOD sites. Due to the sensitivities of information and material at each RF MOD site, there is restricted access for the U.S. side. The TSC will serve to assure compliance with NNSA Program goals by consolidating system data and reporting and respect data sensitivity while fulfilling the need for U.S. assurance of system operation. These relationships are progressing effectively now. An additional benefit to the Program involves the key role that the Technical Center can play in access to its own facilities. Access to information for assurances or system functionality determination can be coordinated with the TSC first and the TSC will have the responsibility of coordinating the access with the multiple RF MOD sites in a consistent and effective manner.

Finally, the Technical Centers will function to maintain the metrics for system sustainability and functionality. The performance metrics will be useful to both the U.S. and Russian side for system operations assurance.

CONCLUSION

Although temporary training activities are occurring in the region that will later be transferred to the Center, the estimated time for the completion of the physical structure of the Kola region TSC is spring of 2005. Approximately one year after this date, the TSC will be fully functional and serving the RF MOD sites in the roles described in this paper. The U.S. will continue to provide support in the integration phase, where the relationships established in support of the TSC are refined. This is consistent with the MPC&A Program's funded and monitored operations phase where cooperation continues with TSC and other sites in the region. The RF MOD has expressed a desire for "funded operations" for the TSC operations in the Kola region until 2007. At that time, RF MOD will take responsibility for the operation and funding of the TSC.

In keeping with the timeline described in paragraphs above, the U.S. must hand over full fiscal responsibility for the support of the systems protecting nuclear material in regions like the Kola Region in a manner that assures continued system operability. The TSC will enhance the effectiveness of this transition strategy in its role as information manager for systems operations. Resource planning metrics and MOD fiscal commitment to the protection missions can be effectively monitored from this central information clearinghouse.

The benefit of developing a TSC will allow for cost savings for infrastructure needs not possible by providing for these needs at each individual site. The TSC will serve as an effective model for all of the concepts described in this paper and provide for the metrics of system effectiveness. There has been strong support for additional regional centers in the Russian Far East for RF MOD site support. The current team hopes this concept extends beyond MOD concerns to all parts of the MPC&A Program to develop centers that will benefit not only their client sites, but also the entire Russian nuclear complex.

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